MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR AND LAND PROTECTION DIVISION
ENVIRONMENTAL SERVICES PROGRAM
Standard Operating Procedures

SOP #: MDNR-WQMS-202 EFFECTIVE DATE: June 2, 2004

SOP TITLE: General Operating Procedures for the Turner Designs Model 10-005R Field Fluorometer

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SUMMARY OF REVISIONS: Information related to chlorophyll-a analysis has been deleted due to instrument and method changes. Minor changes have been made in this document to reflect the new formatting requirements.

APPLICABILITY: The procedures described in this SOP are applicable to all ESP personnel who operate the Turner Designs Model 10-005R Field Fluorometer for use in the detection of rhodamine WT dye.

DISTRIBUTION: MoDNR Intranet
ESP SOP Coordinator

RECERTIFICATION RECORD:

Date Reviewed				
Initials				

1.0 SCOPE AND APPLICABILITY

Hydrological studies are a major part of many water quality surveys conducted by the Water Quality Monitoring Section (WQMS) of the Environmental Services Program (ESP). These studies can include activities such as flow measurement, dye dilution for extent of mixing zone area, and time-of-travel studies. This Standard Operating Procedure (SOP) offers general guidance for operating the Turner Designs Model 10-005R Field Fluorometer in the analysis of water samples collected in association with time-of-travel studies. See SOP *MDNR-WQMS-114* for information regarding time-of-travel studies.

2.0 SUMMARY OF METHOD

2.1 Fluorometry is the measurement and quantification of the process whereby a chemical compound absorbs light at one wavelength and emits it at a longer wavelength. At low concentrations fluorescence is directly proportional to the concentration of fluorescent material present.

2.2 The basic principle behind the use of the fluorometer is to expose a sample of interest to a desired wavelength of light causing it to fluoresce. By measurement of the intensity of this fluorescence, which at low concentrations is directly proportional to the amount of material present, concentrations can be calculated.

2.3 At the present time, the Turner Designs Model 10-005R is limited to use in time-of-travel studies for the detection of rhodamine WT dye.

3.0 HEALTH AND SAFETY REQUIREMENTS

Appropriate personal protective equipment including protective gloves and safety glasses should be worn when conducting fluorometric analysis.

4.0 FLUOROMETER SET-UP PROCEDURES

4.1 The fluorometer can operate on either 12 volt DC or 110 volt AC electrical current. The fluorometer will operate in the static mode which is used with the cuvette holder for grab samples or the continuous mode for using flow through techniques.

4.2 Filter and light source recommendations for the detection of rhodamine WT dye are given in the *Filter Selection Guide* in the Turner Designs *Operating and Service Manual.*

4.3 Although the fluorometer is presently set-up for the detection of rhodamine WT dye, one may refer to the Turner Designs *Operating and Service Manual* for the initial set-up if necessary.

5.0 CONTROLS AND INDICATORS

All operating controls are on the front panel. See figure 2.

5.1 Sensitivity Knob

5.1.1 This knob, its vernier and lock are located on the lower right side of the front panel. This control sets the basic sensitivity of the instrument. Normally this knob is adjusted only when optical filters are changed.

5.1.2 To adjust the sensitivity knob refer to section three of the Turner Designs *Operating and Service Manual*.

5.2 X1 – X100 Knob

This knob is located on the upper right side of the front panel. When in the X1 position, the sensitivity of the instrument is as indicated by the Range Lights. When in the X100 position, the sensitivity of the instrument is 100 times that indicated by the Range Lights.

5.3 Range Auto – Man Switch

When in the *RANGE/auto* position the instrument automatically selects the appropriate range (MIN SENS, X3.16, X10, X31.6). When in the *man* position, ranges are changed only by manually depressing the switch.

5.4 Blank Control

This control is used to compensate for the residual or "blank" fluorescence of the solution in which the unknown is dissolved.

5.5 Span Control

This control is used when it is desired to calibrate the panel meter directly in terms of concentration.

6.0 PANEL METER

6.1 There are two scales on the panel meter; the top scale which spans 1-10 and the bottom scale which spans 1-3.16. Sensitivities 1 and 10 are read on the top scale and 3.16 and 31.6 on the bottom scale. The bottom scale is expanded and allows more accurate readings at 3.16 and 31.6.

6.2 For reasons discussed in the Turner Designs *Operating and Service Manual* as the

concentration of readings increases the two scales should be used alternately, but are otherwise interchangeable. As concentration moves from one range to another it is only necessary to alternate between one scale and another, with due regard to decimal point placement. The table below indicates which scale and decimal placement must be used for each sensitivity.

Range	Sensitivity	Scale	Move Decimal Point
X100	Min Sens	top	2 places left
X100	X3.16	bottom	2 places left
X100	X10	top	3 places left
X1	Min Sens	top	direct reading
X1	X3.16	bottom	direct reading
X1	X10	top	1 place left
X1	X31.6	bottom	1 place left

7.0 OPERATING INSTRUCTIONS

7.1 General

7.1.1 While specific operating instructions are found in SOP-MDNR-WQMS-114, *Determination of Time-of-travel in Streams Using a Turner Designs Field Fluorometer*, the following general instructions should be applied when using the fluorometer.

7.1.2 The fluorometer should be turned on and allowed to warm-up for at least five minutes. Under certain conditions a longer warm-up time may be necessary. Refer to the Turner Designs *Operating and Service Manual* for details. The instrument will then have to be calibrated by setting the basic sensitivity of the fluorometer, and by preparing standards and a blank.

7.2 Sensitivity

Setting the basic sensitivity of the fluorometer is discussed in the SOP-MDNR-WQMS-114 and in section 3 of the Turner Designs *Operating and Service Manual.*

7.3 Standards and Blank

7.3.1 Normally the standard will be a known concentration of the material that is

being tested for. The concentration of the standard should be low enough so that readings can be taken at the higher sensitivities of the fluorometer. When these conditions are met the fluorometer reading is almost always proportional to the concentrations.

7.3.2 When the concentration of the fluorescent material is extreme the readings will flatten out and be nonlinear. When this condition occurs several standards should be prepared to form a calibration curve.

7.3.3 A blank also needs to be prepared so background fluorescence can be subtracted from subsequent samples. This is the same material in which the standards and unknowns are dissolved, but without the material of interest (dye) present.

7.4 Calibration – in general, calibration is accomplished in the following manner:

7.4.1 Insert a blank solution and select the highest sensitivity range for the application (min sens, X3.16, X10, or X31.6).

7.4.2 Unlock blank knob and adjust until the Panel Meter reads zero. Lock the blank knob.

7.4.3 Insert a standard solution and select the appropriate range.

7.4.4 If, at this time, you wish the standard to read at a specific point on the Panel Meter (e.g. 1 on the meter panel to correspond to 1 part per million concentration) you can unlock the span knob and adjust until the panel meter reads as desired. Then lock the span knob.

7.4.5 The fluorometer should now be calibrated.

8.0 SAMPLE ANALYSIS AND DATA REDUCTION

8.1 Samples can now be analyzed by inserting a cuvette containing the samples into the fluorometer, selecting a range that gives mid-scale readings, recording the results, and calculating the concentrations

8.2 Sample readings should be recorded with due regard for decimal placement at a given sensitivity range.

8.3 When taking sample readings, especially when a wide range of concentrations is expected, errors can be reduced by recording all of the factors involved in determining a concentration. For example: X1 or X100 range; Min Sens, X3.16, X10, or X31.6 sensitivity; top or bottom scale; meter reading. An example of a bench sheet can be found in the appendix as figure 1.

9.0 REFERENCES

- MDNR-WQMS-114, *Determination of Time-of-Travel in Streams Using a Turner Designs Field Fluorometer*

- *Operating and Service Manual,* model 10 series fluorometers, Turner Designs, May 1978

APPENDIX

Figures 1 and 2

Figure 1.

Time-of-travel study on: ____

____

Sampling Site: ____

____

Dye Injected at: ____

____________Time/Date:____

Amount Injected: ______________________________Type of Dye: ____________

____________________Conc. %: ______________

Sampling Section Discharge: ____________________________CFS Width: ______

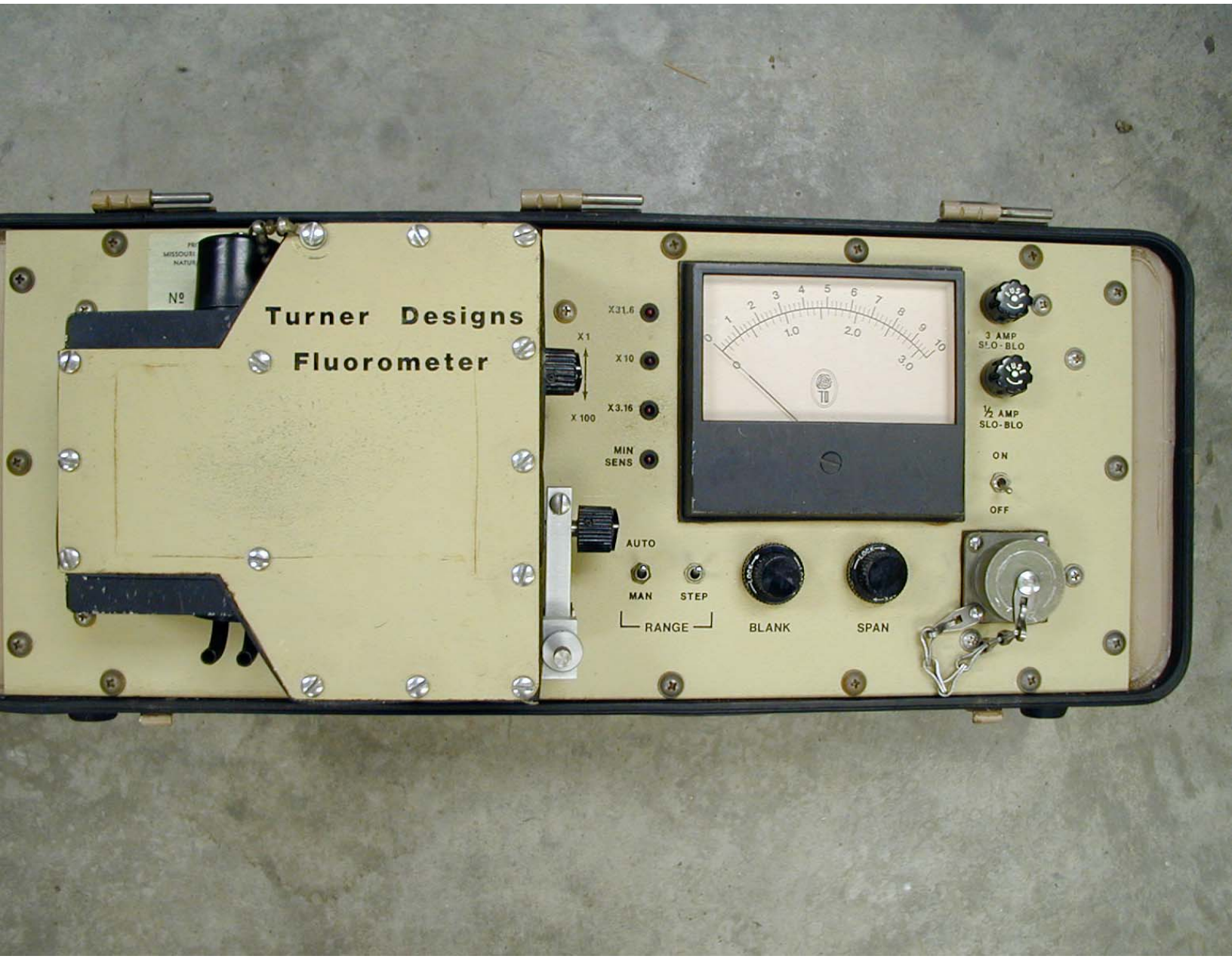
____________Mean Depth: ____________

Field Sampling and Analysis

Laboratory Analysis

Sample #	Sample Point	Sample Time	Fluor. Sens. 1X-100X	Fluorometer Readings				Corrected Readings				Rel. Dye Conc.
				1X	3X	10X	30X	1X	3X	10X	30X	

Figure 2.


Turner Designs
Fluorometer
X31.6
X1
X10
X 100
X3.16
MIN
SENS
AUTO
MAN
STEP
RANGE
BLANK
SPAN
3 AMP
SLO-BLO
½ AMP
SLO-BLO
ON
OFF